0014-003P

BEARING-SUPPORTED DAMPER ASSEMBLY

Field of Invention

The invention of the applicant generally relates to improvements in damper systems, and in particular, to damper systems having a plurality of interconnected vanes pivotally mounted within a support frame.

Background and Summary of the Invention

Conventional damping systems typically include vanes with support or "control" rods simply mounted in a support frame. The vanes are activated by linkage rods which are pivotally connected to the vanes by rocker brackets and trunion pivots. However, when used in dirty or dusty environments, such conventional devices usually result in unreliable and unacceptable operation because friction producing substances get between the support frame and the control rods, and between the linkage rods, trunions, and rocker brackets.

The present invention improves upon conventional damping systems by incorporating sealed bearing assemblies connected to the control rods and trunions. The sealed bearings are mechanically affixed to the associated control rods or trunions permitting the damper blades to move upon completely sealed ball or needle bearings

resulting in efficient dampers that are capable of freely opening and closing regardless of the environment in which the dampers are operating.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a damper assembly according to the present invention.

FIG. 2 is a close-up front elevational view of the damper assembly of FIG. 1.

FIG. 3 is a side elevational view of the bearing-supported trunion pivot of the present invention.

FIG. 4 is a side, cross sectional elevational view taken along line 4-4 of FIG. 3.

FIGS. 5-7 are top, front and side elevational views, respectively of the rocker bracket of the present invention.

Detailed Description

Referring to the drawing, and initially to FIGs. 1 and 2 thereof, the damper system

10 of the present invention includes a frame 12 with a number of usually vertical, spaced-apart support members 18. The damper system 10 also includes a plurality of vanes 16 which are rotatably supported between the support members 18 on support (or "control") rods 20. Bearing assemblies, such as those disclosed in the applicant's copending U.S. application Serial No. 08/734,926, now Patent No. 5845,999, are preferably fixedly connected to the ends of the control rods 20 to provide frictionless rotational support for the vanes 16, thereby greatly reducing the rotational resistance of the vanes 16.

The vanes 16 are rotated by a linkage rod 22 pivotally connected to the vanes 16 by rocker brackets 24 via the novel bearing-supported trunion pivots 26. The linkage rod 22 is actuated by an actuator 28 which can be of any suitable type. It should be noted that the linkage rod configuration depicted is only one of many possible configurations which can incorporate the present invention. For example, the linkage rod 22 could be connected to every alternate vane, with intermediate vanes connected to the "driver" vanes by secondary linkage rods. The secondary linkage rods would be connected to the "driver" and "driven" vanes by separate rocker brackets and bearing-supported trunion pivots.

Referring specifically to FIG. 2, the linkage rod 22 is fixedly attached to the trunion pivot 26 preferably by a set screw 27. The trunion pivot 26 is rotatably seated in a rocker bracket 30 which, in turn, is fixedly attached to the vane 16, thus providing an essentially frictionless pivotal connection between the linkage rod 22 and the rocker bracket 30..

Referring to FIGS. 3 and 4, the trunion pivot 26 includes a body portion 32 having end portions 34,36. The body portion 32 of the trunion pivot 26 preferably has a cylindrical center section 33 of substantially constant diameter. The end portions 34, 36 preferably include neck portions 38,40 having a diameter less than that of the center section 33 of the body portion 32. Connected to the end portions 34, 36 are bearing assemblies 42,44 which have outer housings 46,48, preferably of the same diameter as that of the center portion 33. The body portion 33 of the trunion pivot 26 preferably includes a through-hole 50 for receipt of the linkage rod 22 therethrough. In addition, the trunion pivot 26 preferably includes a set hole and the associated set screw (not shown here) which communicates with the through-hole 50 for fixedly connecting the linkage rod 22 to the body portion 32 of the trunion pivot 26.

Referring to FIG. 4, the trunion pivot 26 is preferably symmetrical such that the bearing assemblies 42,44 are identical. With respect to one end, the inner core 52 and an outer housing 46 enclose either pin- or, as shown, ball-type bearing elements 54. The core 52 preferably has an integral, outwardly extending end 56 which extends from the housing 46 and is received within a recess 58 in the end portion 34 of the body portion 32 of the trunion pivot 26. The extending end 56 of the inner core 52 can be hollow or solid, as shown, and can be fixedly connected to the body portion 32 via mechanical fastening means 60 (such as a spring dowel) inserted through aligned holes 62, 64, 66 in

the body portion 32 and the extending end 56 of the inner race 52.

The overall length of the trunion pivot 26 is preferably about 1.5 inches, and the diameter of the outer housings 46,48 and the center portion 33 are all preferably about one-half inch in diameter. The neck portions are preferably about 3/8 inch in diameter. The width of the neck portions 38,40 are preferably about 1/8 to 1/16 inch each, and the width of the bearing assemblies 42,44 (i.e., the outer housings 46,48 thereof) are each preferably about 1/4 inch. Thus, the length of the center portion 32 of the trunion pivot 26 is preferably about 3/4 to 7/8 inch. The through-hole 54 receiving the linkage rod 22 is preferably about 9/32 inch in diameter to receive the preferably 1/4 inch diameter linkage rod 22. The aligned holes 62,64,66 in the body portion 32 and extending end 56 of the inner race 52 for receipt of the fastening means 60 are each about preferably 5/64 inch in diameter for receipt of a 3/8 inch long dowel pin. The recess 58 in the end portion 34 of the body portion 32 of the trunion pivot 26 is preferably about 1/4 inch in diameter for receiving the extending end 56 of the inner core 52, which extending end 56 is preferably about 3/16 inch in diameter.

As shown, the recess 58 can extend the full length of the body portion 32, intersecting with the through-hole 50. However, the recess 58 can be sized according to the length of the extending end of the inner core 52 which is preferably about 1/4 to 3/8 inch in length as measured from an extreme end portion of the body portion 32 of the

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trunion pivot 26. The bearing assemblies 46,48 each preferably include one row of bearing elements 54 which can be aligned by a spacing element (not shown). The bearing elements are preferably 10 in number with a diameter of 3/32 inch. The junction between the outer housing 46 and inner race 52 is preferably sealed with sealing rings 68,70 to prevent the ingress of particles and other contaminants.

Referring to FIGS. 5-7, the rocker bracket 30 includes wings 72,74 rigidly interconnected by a center member 31, and is fixedly connected to the vane (not shown) via suitable fastening means directed through mounting holes 76 in flanges 78. The outward ends 80,82 of the wings 72,74 include bearing-supporting recesses 84,86, here shown formed by the through holes 88,90 and surrounding bearing-supporting collars 92,94. The rocker bracket 30 is preferably integrally formed by die cutting and stamping in a low cost, high volume manner. Specifically, the through holes 88,90 and collars 92,94 can be formed by progressive die stamping. The bearing-receiving recesses 84,86, including the through-holes 88,90 and bearing supporting collars 92,94 are sized and shaped to closely receive the bearing assemblies 42,44 therein. Preferably, the rocker bracket 30 and trunion pivot 26 are designed such that the trunion pivot 26 can be slidably inserted into the rocker bracket 30 through one of the through-holes 88,90.

The bearing-receiving recesses 84,86 are located to simultaneously contact both bearing assemblies 42,44 of the trunion pivot 26 when the trunion pivot 26 is inserted into

the rocker bracket 30. Thus, preferably the outward ends 96,98 of the bearing-receiving recesses 84,86 are spaced apart a distance substantially equal to the distance between the outward ends of the outer housings 46,48 of the bearing assemblies 42,44 of the trunion pivot 26. In addition, the width of the bearing-supporting collars 92,94 plus the thickness of the material forming the wings 72,74 is preferably substantially equal to the width of the outer housings 46,48 such that the bearing-receiving recesses 84,86 substantially cover the outer housings 46,48 of the bearing assemblies 42,44. The material forming the wings 72,74 of the rocker bracket 30 preferably has a thickness of about .06 inches, therefore, the bearing-supporting collars 92,94 each preferably have a width of about .19 inches. The through-holes 88,90 each have a diameter slightly larger than the diameters of the outer housings 46,48 and the body portion 32 of the trunion pivot 26 such that the trunion pivot 26 may be slidably received within the mounting bracket 30. Therefore, the through-holes 88,90 and the bearing-supporting collars 92,94 each have an inside diameter of approximately .52 inches.

Referring then to FIG. 2, when the trunion pivot 26 is inserted into the mounting bracket 30 and the linkage rod 22 is fixedly attached to the trunion pivot 26 through the through-hole 50, the pivotal connection between the linkage rod 22 and the rocker bracket 30 is substantially frictionless. Therefore, in comparison to prior art designs, the present invention significantly reduces the force and energy required to actuate the damper system while simultaneously increasing the lifespan of the components.

It can be appreciated that the trunion pivots and rocker brackets of the type used in the present invention are inexpensive to manufacture and incorporate into a damper system. Thus, the novel structure of a damper system with trunion pivots having sealed bearing assemblies seated in specially adapted rocker brackets allowing for free pivotal movement of the linkage rod with respect to the vanes provides significant improvements in energy consumption and longevity while avoiding any substantial increase in production costs. The savings and efficiency are magnified in damper systems which have numerous trunion pivots.

It should be understood, of course, that the specific form of the invention herein illustrated and described is intended to be representative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Specifically, the applicant's invention also contemplates sealed bearings incorporated as an integral part of the control rods at either their terminal ends or mid-sections. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.